

WHAT IS CLAIMED IS:

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1. A semiconductor laser element, comprising:

a semiconductor laser region in which at least one laser emission portion including an active layer for emitting light is provided;

a multimode interference region including a first wave-guiding layer, one end of the first wave-guiding layer being optically coupled to the active layer of the at least one laser emission portion; and

an output waveguide region including a second wave-guiding layer, the second wave-guiding layer being optically coupled to another end of the first wave-guiding layer,

wherein the active layer of the at least one laser emission portion, the first wave-guiding layer, and the second wave-guiding layer are integrally formed.

2. A semiconductor laser element according to claim 1, wherein the semiconductor laser region includes a plurality of laser emission portions arranged in a predetermined array.

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3. A semiconductor laser element according to claim 1, wherein the semiconductor laser region, the multimode interference region, and the output waveguide region are provided on the same semiconductor substrate.

4. A semiconductor laser element according to claim 3, further comprising:

a first electrode provided on a lower surface of the semiconductor substrate; and

a second electrode provided at least on an upper surface of the semiconductor laser region.

5. A semiconductor laser element according to claim 4, further comprising a third electrode provided over at least one of the output waveguide region and at least a portion of the multimode interference region.

6. A semiconductor laser element according to claim 5, wherein a bias voltage is applied to the third electrode.

7. A semiconductor laser element according to claim 4, wherein the second electrode extends to at least a portion of an upper surface of the multimode interference region.

8. A semiconductor laser element according to claim 3, further comprising:

a first electrode provided on a lower surface of the semiconductor substrate; and

a fourth electrode provided at least on a upper surface of the multimode interference region.

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9. A semiconductor laser element according to claim 1, wherein the active layer of the at least one laser emission portion, the first wave-guiding layer, and the second wave-guiding layer are integrally formed of the same material.

10. A semiconductor laser element according to claim 1, wherein:

the semiconductor laser region includes a plurality of laser emission portions; and

a plurality of third wave-guiding layers for optically coupling a plurality of active layers of the plurality of laser emission portions and the first wave-guiding layer are provided between the plurality of active layers and the first wave-guiding layer.

11. A semiconductor laser element according to claim 10, wherein the plurality of active layers, the first wave-guiding layer, and the plurality of the third wave-guiding layers are integrally formed of the same material.

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12. A semiconductor laser element according to claim 10, wherein the first wave-guiding layer and the plurality of third wave-guiding layers are formed of a low absorption material.

13. A semiconductor laser element according to claim 12, wherein the first wave-guiding layer and the plurality of third wave-guiding layers are formed of AlGaAs.

14. An electronic device comprising the semiconductor laser element of claim 1, wherein the electronic device supplies a modulation signal to the semiconductor laser element.

15. A semiconductor laser element, comprising:
a semiconductor laser region including at least one laser oscillation portion having an active layer which performs laser oscillation; and

a multimode interference region including a first wave-guiding layer, one end of the first wave-guiding layer being optically coupled to the active layer in the at least one laser oscillation portion,

wherein the active layer in the at least one laser oscillation portion, and the first wave-guiding layer, are integrally formed.

16. A semiconductor laser element according to claim 15, wherein the semiconductor laser region includes a plurality of laser oscillation portions arranged in a predetermined array.

17. A semiconductor laser element according to claim 15, wherein the semiconductor laser region, and the multimode interference region are provided on the same semiconductor substrate.

18. A semiconductor laser element according to claim 15, wherein an output waveguide, from which laser light is emitted, is formed integrally with the multimode interference region.

19. A semiconductor laser element according to claim 15, wherein:

the semiconductor laser region includes a plurality of laser oscillation portions; and

the semiconductor laser element further includes a plurality of input waveguides which have a plurality of second wave-guiding layers for optically coupling a plurality of active layers of the plurality of laser oscillation portions and the first wave-guiding layer provided between the plurality of active layers and the first wave-guiding layer.

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20. A semiconductor laser element according to claim 19, wherein:

a dielectric film is provided between the plurality of active layers and the plurality of second wave-guiding layers; and

the plurality of active layers and the plurality of second wave-guiding layers are optically coupled to each other through the dielectric film.

21. A semiconductor laser element according to claim 19, wherein the first wave-guiding layer and the plurality of second wave-guiding layers are made of the same

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material having a low light absorption.

22. A semiconductor laser element according to claim 21, wherein the first wave-guiding layer and the plurality of second wave-guiding layers are made of AlGaAs.

23. A semiconductor laser element according to claim 19, wherein each of the plurality of second wave-guiding layers has a predetermined equivalent refractive index.

24. A semiconductor laser element according to claim 19, wherein each of the plurality of second wave-guiding layers has a predetermined width.

25. A semiconductor laser element according to claim 24, wherein a manufacturing error in the width of each of the plurality of second wave-guiding layers with respect to the predetermined width is 0.05 μm or smaller.

26. A semiconductor laser element according to claim 19, wherein the geometric pattern of the plurality of second wave-guiding layers is made by a reduction exposure method.

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27. An electronic device including the semiconductor laser element of claim 15, which outputs a modulated signal to the semiconductor laser element.

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1. A semiconductor laser element comprising a substrate, a p-type layer, an n-type layer, and a laser layer, the laser layer being formed on the p-type layer and the n-type layer, and the laser layer being formed on the p-type layer and the n-type layer.